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MINING DEVELOPMENT ON UNGAVA BAY

by

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Shortly after the first World War, the noted polar explorer Vilhjalmur Stefansson drew attention to what he termed « The Northward Course of Empire ».[1] He demonstrated how man's increasing command over the natural environment had enabled civilization to move progressively farther north. He anticipated that this progress would continue at an accelerated rate aided by the advent of aircraft. Canada was at that time consolidating the settlement of its western prairies, and the « northward course » could scarcely be said to have touched the 60th parallel of latitude. Yet Stefansson beliveved, as did other farsighted observers, that the inherent facts of physical geography would inevitably — if slowly, permit extension of frontier to the northern limit of the lands. In considering such possible expansion beyond the « railway belt », it has been generally recognized that the economic frontier would be extended most speedily by exploitation of minerals. This was recognized as long ago as 1916 by Dr. Charles Camsell when he wrote : « It is to the mining industry more than any other that we must look for co-operation and assistance in the exploration of our northern regions. » [2]

At least until World War II this viewpoint was justified by experience, for the modest northward progress of the frontier to Yellow Knife, Radium, and Norman Wells had been due to mining. Since then, « the frontier », which has now reached the arctic seas, has owed its progression mainly to military enterprise aided by enormous public resources. Yet, military or commercial, it has only been possible because of increased technical knowledge and logistic skills. Construction of a DEW line, or the operation of arctic military airfields are based on and contribute to man's technical mastery of this relatively new and unknown arctic environment. Military activities have tended to obscure the steady though far slower northward march of industry, particularly of mining.

The present paper discusses a single mining project that may have far-reaching effects on the future of Canada's eastern Artic. It outlines some of the factors influencing plans for exploiting iron on the western shore of Ungava Bay in northern Québec. Though in relatively low latitude this deposit is within the true Arctic, and plans for its utilization will have to face most of the physical problems that will be encountered by industry as it moves still farther north.

The Ungava iron ore project had its root in the growing world-wide need of the steel industry for new sources of iron ore. This long-term demand is common to both North America and Europe. It is now so strong that ores once

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[1] *The Northward course of Empire* by V. Stefansson, New York, 1922.

[2] CAMSELL, Charles, *The unexplored areas of continental Canada*, in *Geographical Journal*, Vol. 48, pp. 249-257.

considered of too low a grade for commercial use are being mined. The ability to process or beneficiate low-grade ores makes it economically possible to exploit those with as low as 30% iron content even when relatively distant from markets.[3]

The recent development of iron ore mining at Shefferville in central Québec, from where the ore is shipped by rail to the North Shore of the St. Lawrence for transfer by water both to Canada and United States steel mills, has focused attention on this formerly remote area. As is well known, the structural trough, in which the Shefferville deposits occur, extends northward toward Ungava Bay, and ore has been found at intervals throughout its length and in fact as far north as Diana Bay on Hudson Strait. These northerly occurrences are, however, appreciably lower in iron content than those now worked in central Québec.

Although Ungava Bay may appear remote when viewed from southern Canada, it is of course in barely 60°N. latitude and is within the « Arctic » region only because of the southeast-ward trend of the summer isotherms which brings the treeline much farther south in eastern Canada than in the west. Furthermore, this seemingly remote area is near Hudson Strait beside the old trading route that since the XVIIth century has been used every year by vessels « trading into Hudson's Bay ». Shipping routes across the Atlantic are surprisingly short in this latitude. Thus from Ungava Bay to Great Britain the distance is about 2,200 nautical miles (4,375 km.) as compared with 2,700 nautical miles (5,000 km.) from Montréal.

Despite some advantages of location there are, however, considerable physical problems in pioneering the development of mining in such a region. While many of them have been faced and overcome elsewhere in the north, some of them are peculiar to this site. The main physical factors of importance are :

1. The iron content of the local ores is relatively lowrunning, usually to about 35%. The ore is rather complex though much of it is magnetite.

2. The area is undeveloped. There is no appreciable local population — apart from a small number of Eskimos and a few traders and other settlers from south — and there is as yet no transportation system.

3. Ungava Bay is open to shipping for possibly 4 to 4½ months each year (from mid-July until late November). The source of the ice that obstructs shipping is threefold. Local ice forms within Ungava Bay itself and especially in the coastal inlets. Of greater significance is ice passing through Hudson Strait from the west and eddying into Ungava Bay. A third source is heavy polar ice from the north passing southward along the east coast of Baffin Island and sealing off the entrance to Hudson Strait. However, the location of Ungava Bay is relatively favourable because of its proximity to consistently open water in southern Davis Strait.[4]

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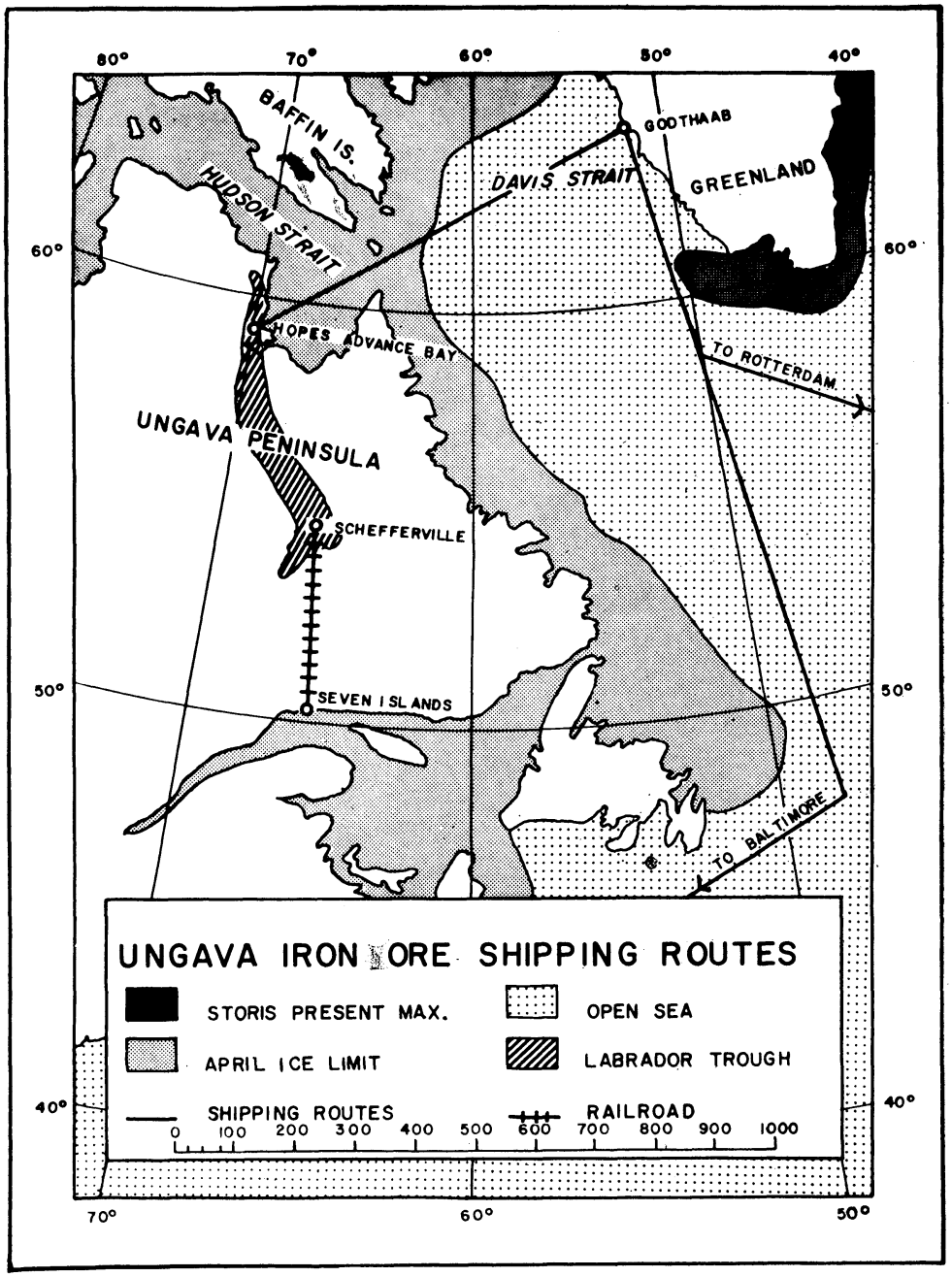
[3] LLOYD, Trevor, *Iron ore production at Kirkenes, Norway*, in *Economic Geography*, Vol. 31, No. 3, 1955, pp. 211-233.

[4] DRINNAN R. H., and PRIOR, L., *Physical characteristics of the Ungava Bay area*, in *Geographical Bulletin*, No. 7, pp. 17-37.

FIGURE I


80°
70°
60°
50°
40°
BAFFIN IS.
HUDSON STRAIT
DAVIS STRAIT
GODTHAAB
GREENLAND
60°
HOPES ADVANCE BAY
TO ROTTERDAM
UNGAVA PENINSULA
SCHEFFERVILLE
50°
SEVEN ISLANDS
TO BALTIMORE
UNGAVA IRON ORE SHIPPING ROUTES
STORIS PRESENT MAX.
APRIL ICE LIMIT
OPEN SEA
LABRADOR TROUGH
SHIPPING ROUTES
RAILROAD
0 100 200 300 400 500 600 700 800 900 1000
40°
70°
60°
50°

4. Tides in Ungava Bay are exceptionnally high — being comparable with those in the Bay of Fundy.[5] This is an asset in that it aids in breaking up and dispersing the ice, but it may raise problems in the handling of very large deep-draught ore vessels, and in the construction of wharves.

5. There is no skilled labor force available locally, and the large number of work-people required to operate the mine and auxiliary plants will need to be brought in from the south. They will necessarily need to be provided with « all the comforts of home », and in addition with frequent and safe transportation to and from settled parts of Canada. Most of the supplies required in the area will need to be imported, either from southern Canada or from overseas.

The overall plan for exploiting iron ore resources on the west side of Ungava Bay consists of several parts :

1. Preliminary exploration of the area, including biological and mineralogical studies, basic hydrographic surveys, meteorological observations, etc., all preliminary to actual exploitation.

2. Construction of a port, airfield, power plant, townsite, mining facilities, along with the elaborate mill needed for beneficiation of the ore.

3. Operation of the mine and mill under the special conditions met with at such a locality.

4. Shipment of the processed ore (in the form of pellets of concentrate) to markets in North America and Europe.

None of the requirements listed present problems not met and overcome elsewhere, with one possible exception, item 4. This deserves further comment if only because of its intrinsic interest from a geographical viewpoint. Essentially the requirement is to transfer at least 5 million tons of iron ore pellets from a port, probably at Hopes Advance Bay, on the west shore of Ungava Bay, to markets in eastern North America, the United Kingdom, and continental Europe. Distances in nautical miles to typical ports in these three market areas are as follows :

Hopes Advance Bay to Glascow	2,200 miles (4,375 km.)
Hopes Advance Bay to Rotterdam	2,650 miles (4,910 km.)
Hopes Advance Bay to Baltimore	2,500 miles (4,630 km.)

As regards distance alone, Ungava Bay is clearly well located and should be in a position to meet competition from other sources. The outstanding question is now to ship about 5,000,000 tons of concentrate from the port in about one-third of the year, i.e. between July and November. Even by using large vessels of the order of 70,000 tons, a size which is becoming customary for such purposes, it would be difficult to provide a sufficiently large fleet with the added problem of utilizing the vessels during the remaining 7 or 8 months. One solu-

[5] See details in *Labrador and Hudson Bay pilot*, Ottawa, 1954.

tion, and the most practicable so far devised, is to provide a transfer-station in ice-free waters. With this arrangement it would be possible to ship the ore from the port during the open season, stockpiling it where it could later be picked up for shipment to the final destination. If the transfer port were located at Hopes Advance Bay, it would provide a steady year-round source of iron ore for the blast furnaces, something not at present possible from any other port in North America.

To be satisfactory, such a transfer station would need to be relatively close to Ungava Bay, be accessible at all seasons, and provide a sheltered location for loading and unloading large vessels.

The east coast of North America needs to be excluded because of the flow of ice from the north. Even sites as far south as Newfoundland would be of doubtful merit, since, as was demonstrated in the 1956-57 winter, all or almost all of them are liable to be, for a time, closed by heavy pack-ice. The only alternative sites lie on the opposite side of Davis Strait, along the southwest coast of Greenland. This coast, in common with other western coasts in high latitude, has a relatively favourable climate with warm off shore waters. This explains why, even a thousand years ago, it was selected as a site for Norse colonies, and why of all parts of the Greenland coast it is the only one with a comparatively large permanent population today.

The possibility of using such a West Greenland site depends upon three main factors : 1. Ice conditions ; 2. Location of a suitable harbour, and not least ; 3. Willingness of Denmark to permit, or even encourage such a project.

Ice conditions near the southwest Greenland coast are peculiar. There are in general three main sources of ice. That formed locally is of concern only in the fjords and other inlets and does not extend to the open sea. Thus, the inner ends of some large fjords may be covered with new ice of up to two feet in thickness so that shipping without ice breakers is curtailed for a few months each year. For example, the inner harbour at Godthaab may, if left undisturbed, have a layer of ice of few inches thick by the end of February. Such ice, if it exists at all, is no problem and is no more serious than that met with in ports on the United States northeast coast and less so than in such a well-frequented port as Copenhagen. The second possible source of ice is that formed in the open sea to the north. This usually extends north of a line running from the Greenland coast diagonally toward the southwest near Labrador. On the Greenland side this is usually only of importance north of the Arctic circle, but in unfavourable years it may extend somewhat farther south. When it breaks up in spring this ice, and that coming from still farther north, usually flows south along the east side of Davis Strait or toward the center. It is not a problem near the southwestern coast of Greenland.

The main problem along this coast is met with in summer when ice approaches from the south ! This arrangement is due to the powerful east Greenland current which carries large masses of heavy polar ice (usually termed *storis*) and some icebergs southward through Denmark Strait, between Iceland and Greenland, and so eventually around Cape Farewell where a current carries it along the southwest coast. In determining the usefulness of a port along this coast it

is necessary to trace the varying limits of the ice floes over a long period of years. This is complicated by the fact that, in the past thirty years, the occurrence of ice has been less severe than in the early part of the century. Hence, present conditions are particularly favourable and there is the possibility that more ice may occur in years to come. Study of the ice records, which have been kept for many years at all larger Greenland settlements, indicate that it is rare for *storis* to reach as far north as Godthaab in latitude 64°N.lat., but that such a port as Julianahaab in latitude 61°N.lat. or the cryolite mining settlement Ivigtut a little farther north, may expect to be closed by *storis* for at least some weeks in most years.

PHOTO I

Summer pack-ice (*storis*), Prinz Christian Sund, south Greenland.

Fortunately, Godthaab is not only far enough north to be spared the effects of *storis*, but also far enough south to avoid the pack-ice from the north and west. It is also well located near the outer coast and so not troubled by serious local winter ice. It would seem that somewhere in this general locality is the most suitable site for a port from the point of view of freedom from obstruction by ice. It is interesting to recall that from the time of John Davis (1585) this fact has been recognized by sailors and that today Godthaab is the capital and main distribution point.

Location of a suitable harbour for large vessels is, of course, quite another question. Although the coast is in general wellknown, having been used regu-

larly by Danish and other trading vessels for more than 250 years, it has never been visited by very large ships. There is furthermore no local experience in handling such vessels under the varying weather and sea conditions to be expected in these latitudes. Search for a suitable harbour was carried out in 1956 using three approaches. First and most important was to gather local knowledge from experienced Danish and Greenland navigators. This suggested that there were (apart from considerations of ice) many possible harbours, some far inland within the deep fjords. The study of these and other possibilities was handicapped by a shortage of good detailed hydrographic charts but was aided by excellent

PHOTO II

Godthaab, Greenland. Town and harbour looking east.

air photographs made available by the Danish authorities. On the basis of local knowledge and study of charts and photographs about thirty possible sites were selected between Godthaab and Julianahaab. A two-month geographical survey carried out by Commander David C. Nutt, using the hydrographic schooner *Blue Dolphin*, reduced this number to about half a dozen. The choice between them depended on an assessment of many factors — ice conditions and other navigational aspects, availability on shore of a suitable site for stockpiling the ore and construction the loading and unloading gear, accessibility to existing settlements, etc. From the combined counsel of navigators, engineers, geographers and administrators it was concluded that a site on an island near Godthaab

offered the greatest advantages. This was selected provisionally, subject to detailed hydrographic studies and to microclimatic studies that would reveal any special disadvantages from storms, heavy snowfall, icing of stockpiles and so on.

Perhaps the most important uncertainty to be settled, and one less amenable to a purely scientific approach, was the attitude of the Danish and Greenland authorities to such a large-scale industrial undertaking. Fortunately, the reforms that had been initiated in Greenland in 1950, following a thorough study by a Royal Commission in Copenhagen, permitted and even encouraged the provision of alternative means of livelihood for the local population.[6] Greenland is no longer firmly closed to outside influences as it was for more than a century, and the social, economic, and political advancement fo the native Greenlanders is being strongly supported by the Danish authorities. The provision of a modern iron ore port with its attendant mechanical facilities and opportunities for skilled employment was therefore not unwelcome. The port, to be built and operated by a Danish company, would, it was thought, be a useful addition to the economy previously based largely on commercial fishing, sheep raising, some mining, and, particularly farther north, on the traditional seal hunting.

One outcome of the decision to proceed with construction of a port in Greenland, as the best possible « gateway » through which Ungava ore could reach world markets, will be a renewal of a tie that originated more than a thousand years ago. The natives of Greenland are of course closely related to Canadian Eskimos and the regular shipping route to be established between Northern Québec and southwest Greenland will renew this link broken long ago. Furthermore, it will reopen on a commercial scale the old shipping route that once linked the Norse settlements in Greenland with Labrador and the opposite shore of Davis Strait.

As mining develops on the northern coast of Quebec, and the attendant problems of operating a modern community on the fringe of the Arctic are met and solved, similar industries may be established still farther north. A sound economic solution of the Ungava Bay ore shipment problem through use of West Greenland may lead the way to use of the same means by Baffin Island mines. Thus the « northward course » of industrialization in the eastern Arctic may be made possible by a fruitful collaboration between Canada and Danish Greenland.

[6] A useful general account of modern Greenland is *Greenland.* Danish Ministry for Foreign Affairs, Copenhagen, 1955.